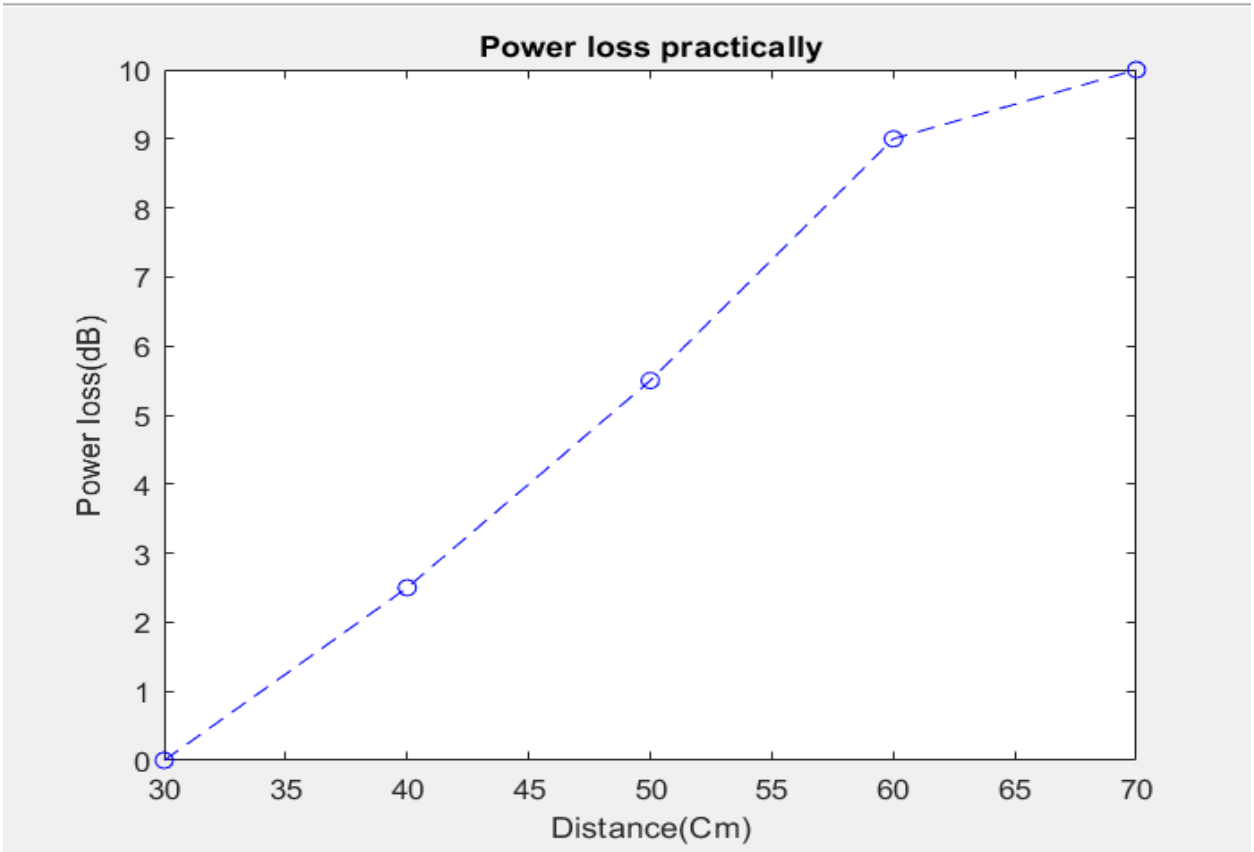
Antenna

Lab 1

Name	ID	Section
Mohamed Samir Abdelrahman	18011483	8
Mariam Hossam Eldin Saleh	18011752	8
Ahmed Mahmoud ElDokmak	18010248	8

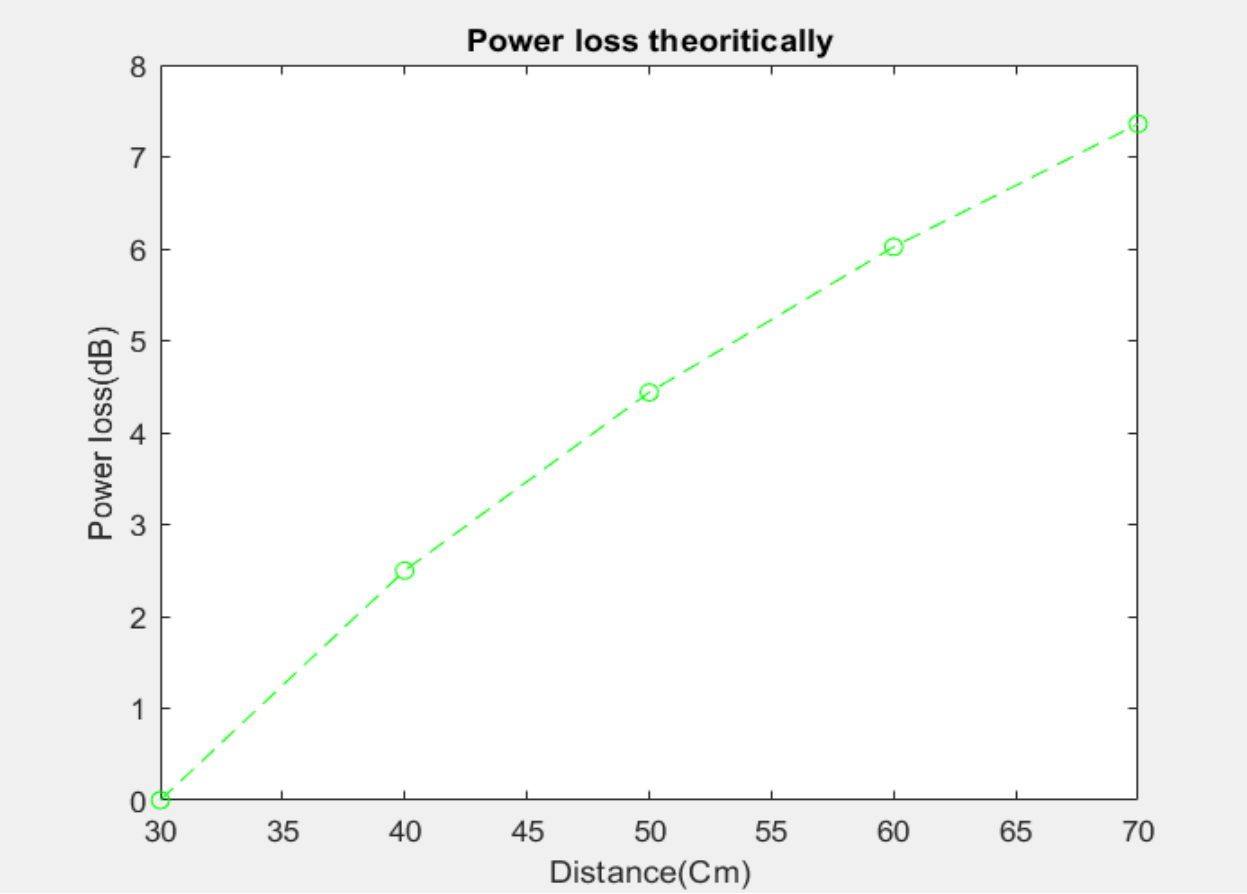
A. Power loss with distance

- Practically :




```
%% Practical
r = [30 40 50 60 70];
PL = [0 2.5 5.5 9 10];
figure;
plot(r,PL,'b--o');
xlabel('Distance(Cm)'); ylabel('Power loss(dB)');
title('Power loss practically');
```

- Theoretically




```
%% Theoritical
r = [30 40 50 60 70];
PL_theo = 20*log10(r / 30);
figure;
plot(r,PL_theo,'g--o');
xlabel('Distance(Cm)'); ylabel('Power loss(dB)');
title('Power loss theoritically');
```

B. Gain Calculations

Given :

$\boldsymbol{f} = 10.5\ GHz$

$\boldsymbol{r} = 30\ cm$

$\boldsymbol{P_R}\ (r = 30\ cm) = -43dB$

$\boldsymbol{P_T} = -30dB$

Calculations:

$$\boldsymbol{\lambda} = \frac{c}{f} = \frac{3 * 10^8}{10.5 * \ 10^9} = \frac{1}{35}\ m$$

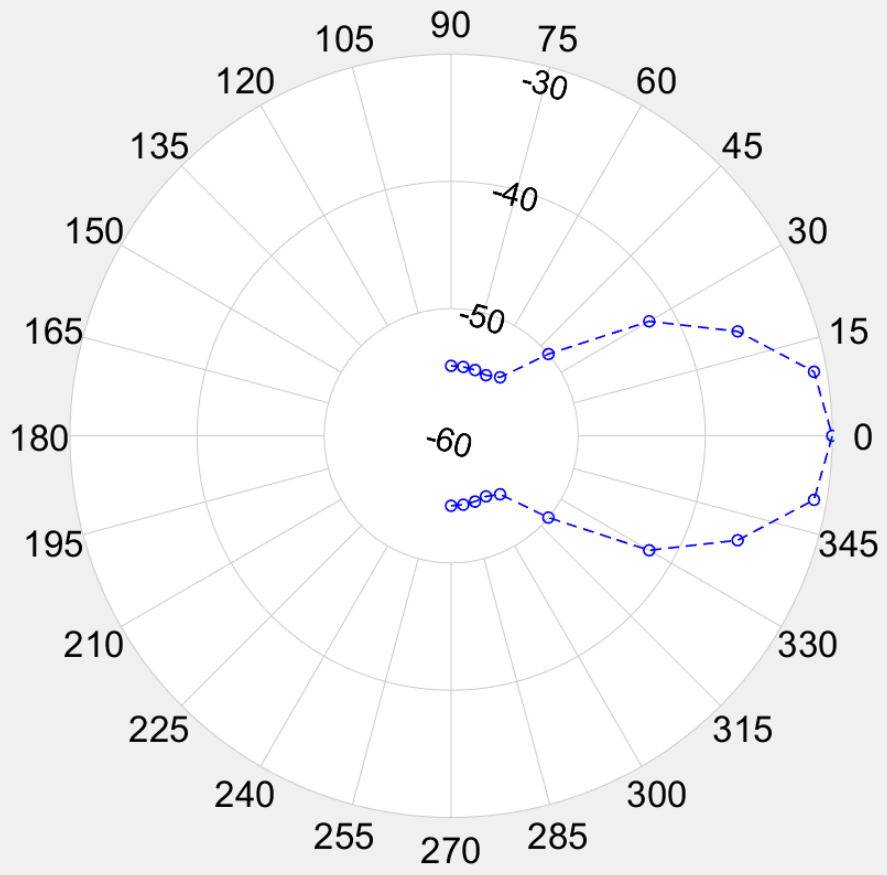
$$\boldsymbol{P_R} = 10^{-\frac{43}{10}} = 5.012 * 10^{-5}\ Watt$$

$$\boldsymbol{P_T} = 10^{-\frac{30}{10}} = 1 * 10^{-3}\ Watt$$

$$\boldsymbol{Gain} = \frac{4\pi r}{\lambda}\sqrt{\frac{P_R}{P_T}} = 29.5$$

$$\mathbf{Gain}|_{\mathbf{dB}} = 10\log(29.5) = 14.7\text{dB}$$

C. Radiation Pattern




```
%% Radiation Pattern of horn antenna
theta = [-90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90];
PR = [-54.5 -54.5 -54.5 -54.5 -54 -50 -42 -36 -31 -30 -31 -36 -42 -50 -54 -54.5 -54.5 -54.5 -54.5];
polarpattern(theta, PR, 'b--o');
```

D. Questions

1. **<u>Free space propagation</u>** : Loss between 2 isotropic antennas if free space.

<u>Far-field region</u> : Region far enough from the antenna so the radiation pattern will be independent of the distance.

2. $\mathbf{P_L|_{dB}} = 20\log\left(\frac{r_2}{r_1}\right)$

We have power loss equal 1dB, sub in the previous equation

$\frac{\mathbf{r_2}}{\mathbf{r_1}} = \mathbf{10}^{\frac{\mathbf{P_L|_{dB}}}{\mathbf{20}}} = \mathbf{1.122}$

3. It's important to conduct the exp in an empty environment to avoid error in measurement due to reflections from other objects.

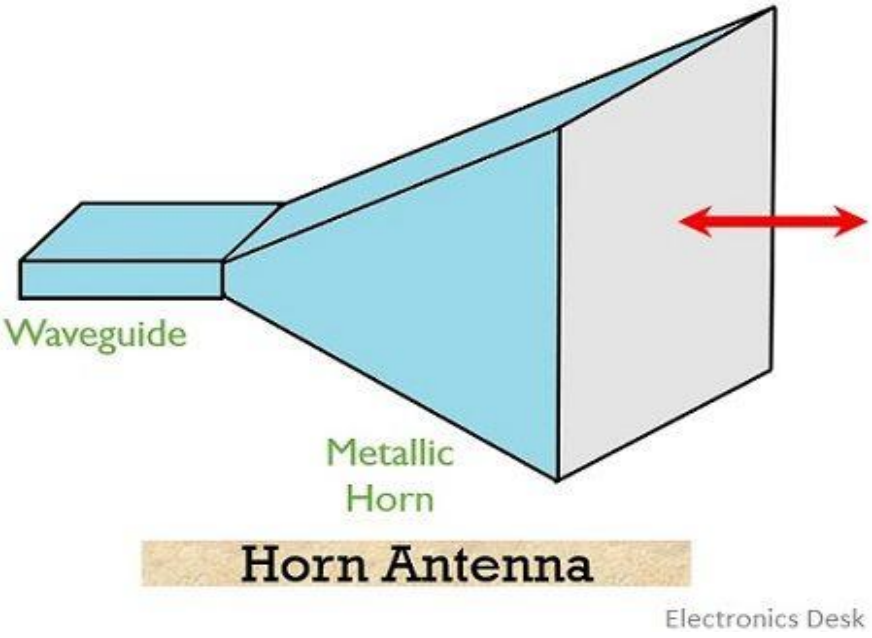
4. We measure the gain by comparing the power received by a refrerence antenna ($\mathbf{P_{ref}}$) to the power received by antenna being tested ($\mathbf{P_{test}}$).

$\mathbf{Gain_{test}} = (\frac{\mathbf{P_{test}}}{\mathbf{P_{ref}}})\mathbf{Gain_{ref}}$

5. No, as they will have different radaition pattern(the 2 antennas aren't identical)

6. It is important to turn the receiver antenna in a direction away from the observer instead of turning it in the direction of observer as the observer's body may affect on the measurements.

7. If we removed the horn it will be a waveguide antenna



8. SWR meter measures relative power and more sensitive while power meter measures absolute power.